

Deflection Magnetometer Modeling with the use of Optical Mouse as a Motion Sensor

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Abstract

Magnetism is a difficult topic to learn. The use of learning media proved to facilitate the learning process. In this study, a model of deflection magnetometer was created to show the effect of the magnetic field as a learning media as well as a magnetic field measuring instrument. The magnetometer was modeled using an optical mouse as a motion sensor that reads the damped oscillations of the circular plate compass inside of a magnetic field. The magnetic field that affects the magnetometer is the resultant of the solenoid's magnetic field and the earth's magnetic field. The measurement of the earth's magnetic field was carried out experimentally using solenoid with length, l , 0.104 m, number of turns, N , 427 which carried with varied direct electric current, I . The results of magnetometer measurements on the strength of the solenoid magnetic field were summed with the measured earth's magnetic field by vector operation to obtain the actual magnitude of the solenoid's magnetic field. Furthermore, the obtained magnitude was compared with mathematical calculations using Biot Savart's Law on finite length solenoid. From the modeled magnetometer in this study, measured magnitude of the earth's magnetic field around Salatiga is $(3.05 \pm 0.07) \times 10^{-5}$ T with 2% relative deviation. While the qualitative measurement of solenoid's field using modeled magnetometer yields relative deviation as much as 2% in magnitude of the magnetic field reading and 3% in the direction of the magnetic field reading.

Keywords: magnetometer, optical mouse, solenoid, damped oscillation